Weight for weight replacement of wheat offal with cassava root sievate in growing rabbit diet¹Egbeyale, L. T. *, ²Idowu, O. M. O. ¹Sogunle, O. M., ³Amole, T. A.,¹Ogundipe, B. O. and ¹Adeleye, O. O.¹Department of Animal Production and Health,
University of Agriculture, Abeokuta, Nigeria.²Department of Animal Nutrition, University of Agriculture, Abeokuta, Nigeria³Institute of Food Security, Environmental Resources and Agricultural Research,
University of Agriculture, Abeokuta, Nigeria

*Corresponding author: lawtoks23@yahoo.co.uk

Abstract

A ten week feeding trial was conducted to investigate the dietary effect of Cassava Root Sievate (CRS) based diet on the performance, nutrient digestibility, blood parameters and carcass characteristics of weaner rabbits. Forty-eight (48) crossbred, 7 weeks old weaner rabbits were used in the feeding trial in a completely randomized design. The CRS replaced wheat offal at 0, 5, 10, 15, 20, 25 and 30%, respectively resulting in seven dietary treatments, respectively. No significant ($P>0.05$) difference was observed between the rabbits fed the CRS and control diets in all the performance indices except the daily and final body weight. Weight gain however decreased significantly ($P<0.05$) as the CRS level increased in the diet. The treatment effect was significant ($P<0.05$) with the highest crude protein, crude fibre and dry matter digestibility values recorded for the rabbit in the control group. Daily energy intake and retained, digestible energy, metabolizable energy and gross energy were similar ($P>0.05$) across treatments. Biological value and apparent nitrogen digestibility were significantly ($P<0.05$) decreased with increased CRS level. Blood serum metabolites of the rabbits were also positively ($P<0.05$) influenced by the treatments. The carcass characteristics showed significance ($P<0.05$) in terms of carcass yield percentage with 20% CRS treatment group having the highest carcass yield percentage. It was concluded in this study that CRS could be included in weaner rabbit diets up to 20% without compromising performance, carcass yield, digestibility and nutrient utilization.

Keywords: Cassava root sievate, wheat offal, rabbits, performance

Introduction

Agricultural wastes from crops in the rural, sub-urban and industrial settlements have often constituted health hazards due to inadequate means of disposal. Most agricultural wastes can therefore potentially contribute to pollution. Projected increases in agricultural production in Nigeria suggested that unless adequate plans are made to channel agro-industrial wastes into productive systems, it may become increasingly difficult to dispose of large quantities of these without an unfavourable repercussion on the environment. The high demand of animal protein and rapidly increasing population in developing countries are major constraints militating against the availability of the much-needed high standard of living. This almost inevitably calls for an increase in

availability of animal protein sources. This situation calls for production of fast maturing animals like rabbits which can utilize cheap and locally available feedstuffs. Nigeria produces large quantities of agricultural and agro-based industries by-products some of which are regarded as non-conventional feed sources. Cassava peels (Agunbiade *et al*; 1999), Kolanut pod (Oluokun and Oladokun 1999) and forage (Oduozo and Adegbola, 1992) were classified in this group and have been found to be efficiently utilized to produce meat.

Rabbits have been reported to survive successively on diets based on roughages supplemented with agricultural by-products (Cheeke, 1983). To achieve efficient utilization of these agricultural by-products, it is very essential to have

knowledge of their nutritive value and the performance response of animals to them. Some of the limiting factors associated with the use of crop residues and agro-industrial by-products as animal feeds include procurement, storage, poor feed intake, high fibre content, toxic substances, low digestibility and low nutrient contents and consequently low animal performance (Alawa and Amadi, 1991; Adegbola and Oduozo, 1992).

Cassava Roots sievate (CRS) is an agricultural by-products derived from cassava flour after sieving. It contains high fibre content but low protein content. Dietary fibre plays an important role in digestive process in rabbits because it helps to maintain a high rate of passage, especially of those fibre particles larger than 0.315mm, which prevents an accumulation of digesta in the caecum and hence reduces feed intake and impairs growth (Gidenne, 1993; DeBlas *et al.*, 1999; Garcia *et al.*, 1999). This study was therefore designed to determine the effect of replacing wheat offal with CRS on dietary nutrients intake, utilization and digestibility by weaner rabbits.

Materials and Methods

Experimental design and management

A total of eighty-four (84) cross bred weaner rabbits with average weight of 550 to 556g were divided at random into seven dietary treatment groups of twelve (12) rabbits each on weight equalization and each treatment group was divided into three replicates of four rabbits each. The treatments were arranged in a Completely Randomized Design with CRS as the only dietary source of variation. Seven experimental diets were formulated to contain 0, 5, 10, 15, 20, 25 and 30% CRS respectively (Table 2). The experimental rabbits were kept in a hutch equipped with

feeders and drinkers. Feed and water were provided *ad-libitum* throughout the experimental period. The experiment lasted for ten (10) weeks.

Data collection

Average feed intake, body weight and body weight gain were measured weekly. Feed conversion ratio was calculated for each replicate.

Carcass characteristics

At the last day of the experiment, the rabbits were weighed to get their mean live weight and nine rabbits per treatment (three per replicate) were selected for carcass characteristics and organ weight determination. The animals were starved for 24 hour prior to slaughtering but water was supplied *ad libitum*. This was to avoid their carcass weight being confounded by weight of undigested feed and to prevent dehydration respectively. They were slaughtered using sharp knife, dehaired, eviscerated, split into wholesale cut-parts (head, neck, fore limbs, hind limbs, thoracic region, lumbar region and cervical region) and organs (liver, kidney, heart, and lung) and weighed using sensitive scale.

Nutrient utilization coefficients

At the expiration of nine weeks, fifteen rabbits per treatment were selected randomly and housed individually in metabolic cage of 50cm x 50cm x 40cm in dimension that allows collection of faeces and urine separately without contamination. Three days acclimatization period were observed prior to data collection. Total feed intake, faecal output and urine voided were recorded for four days. The faecal samples collected were oven dried at 78°C for 24 hours and were re-weighed before storage in a dessicator prior to analyses. Daily urine was collected in a stainless containing 2ml of 0.01M hydrochloric acid as preservative until required for analysis.

Blood sampling

Rabbits selected for the metabolic trials were thoroughly bled on the last day of the metabolic trial. Five ml of blood was collected from each rabbit into a sample bottle containing Ethylene Diamine Tetra-acetic acid (EDTA) as anti-coagulant and in another set of bottles without EDTA for serum metabolites. The blood samples were analyzed for total protein, albumin creatinine, serum glutamic oxaloacetate transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT) and glucose using analytic test kits (Benjamin, 1978).

Chemical analysis

Samples of CRS, wheat offal and experimental diets were analyzed for proximate components as described by AOAC (1995). The milled samples of feed, dried faeces and aliquots of urine were analyzed for nitrogen using micro Kjeldahl technique while the gross energy content of the faeces and urine were determine using Gallen Kamp oxygen bomb calorimeter.

Statistical analysis

Data collected were sublected to one-way Analysis of Variance in a completely Randomized design using General Linear Model (GLM) procedure of SAS (1999). Significant ($P < 0.05$) differences among means were separated using Duncan Multiple Range Test (Duncan, 1955).

Results and Discussion

The proximate composition of CRS (Table1) obtained agreed with the data reported by Oduwefo, (2003) except for the ether extract and ash that were lower (0.50 and 2.50 compared to 2.30 and 6.23 respectively). This difference was probably due to cassava variety differences. The CRS contributed to the high content of crude fibre of the resulting diets which in part influenced the feed intake. The crude fibre content and gross energy (GE) of the diets increased with increased levels of CRS. In contrast, crude protein, ash and ether extract contents followed a downward trend with increasing level of non-conventional feed resources in the diets (Table2). The low crude protein value of CRS (1.08%) was not surprising as many researchers had confirmed the low protein content of cassava and cassava by-products when compared with protein content of cereals grains.

There was no significant ($P > 0.05$) difference in the feed intake (Table3) but a numerical increase in the feed intake of CRS diet over the control diet was noticed. The rabbit must have eaten more of this diet to meet their energy requirement. Lebas (1983) stated that a growing rabbits is able to adjust its voluntary feed intake according

Table 1: Composition of the Wheat Offal (WO) and Cassava Root Sievate (CRS)

Parameters (%)	WO	CRS
Dry matter	91.20	87.42
Crude protein	15.40	1.08
Crude fibre	10.00	21.00
Ether extract	3.40	0.50
Ash	6.00	2.50
Nitrogen free extract	56.40	62.33

WO = Wheat offal, CRS = Cassava Root Sievate

Table 2: Composition of the experimental diets

Ingredients	Dietary Treatments						
	0	5	10	15	20	25	30
Maize	39.0	38.00	36.00	35.00	34.00	33.00	30.00
Wheat Offal	30.0	25.00	20.00	15.00	10.00	5.00	-
CRS	-	5.00	10.00	15.00	20.00	25.00	30.00
Soya meal	11.00	13.00	15.00	17.00	18.50	19.00	
Blood meal	0.20	0.20	0.20	0.20	0.20	0.20	0.20
BDG	19.30	17.30	17.30	16.30	15.30	14.80	17.30
Oyster shell	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Determined analysis							
Crude protein	17.06	17.01	16.98	16.76	16.55	16.26	16.18
Crude fibre	6.84	7.32	7.95	8.49	9.03	9.59	10.39
Ether extract	4.81	4.50	4.75	3.98	3.71	3.44	3.30
Ash	3.83	3.71	3.61	3.47	3.34	3.19	3.11
GE (kcal/g)	10.01	10.12	10.20	10.31	10.43	10.55	10.60

to the energy concentration of the diet. Final body weight and weight gain showed significant ($P<0.05$) difference. The weight gain was significantly ($P<0.05$) reduced mainly across a treatment group (Table 3) which was similar to linear reduction noticed in the dietary crude protein and energy contents (Table 2) or as level of CRS increased. The marked depression in weight gain was similar to the finding of Adegbola and Okonkwo (2002) who noticed similar depression as a result of feeding cassava leaf meal and Jegede *et al.* (2006) who fed malted sorghum sprout to growing rabbits. In the same vein Adeyemi *et al.* (2008) observed similar range in daily weight gain

when they fed fermented corn cobs to rabbits.

The dry matter digestibility showed a marked decline ($P<0.05$) as the CRS increased in the diets, this may be as a result of dietary fibre build up in the diets (Table 2). The DM digestibility of rabbits on the various treatments were relatively high (51.72 to 75.50%) and similar to the values (66.67 to 75.69%) reported by Igwebuike *et al.* (2008) who fed graded levels of *Acacia albida* pods. The crude fibre (CF) digestibility was significantly ($P<0.05$) reduced with increased fibre contribution by the CRS (Tables 2 and 4). The CF digestibility decreased from 60.18 in the

Table 3: Performance of weaner rabbits fed experimental diets

Ingredients	Levels of inclusion of CRS (%) in experimental diets						
	0	5	10	15	20	25	30
Initial BWT (g/rabbit)	550.00	556.00	551.00	550.00	550.00	550.00	555.00
Final BWT (g/rabbit)	1550.30 ^a	1520.60 ^a	1444.20 ^{ab}	1443.20 ^{ab}	1443.20 ^{ab}	1411.80 ^b	1401.60 ^b
Weight gain (g/rabbit/d)	14.29 ^a	13.78 ^b	12.76 ^c	12.76 ^c	12.76 ^c	12.31 ^d	12.09 ^d
Feed intake (g/rabbit/d)	55.46	53.70	54.03	56.38	56.27	57.40	58.06
Feed conversion ratio	3.88	3.90	4.23	4.41	4.41	4.66	4.80

Means along the same row with different superscripts are significantly different ($P<0.05$)

Table 4: Nutrient utilization of rabbits fed CRS based diets

Measurement	Levels of inclusion of CRS (%) in experimental diets							SEM
	0	5	10	15	20	25	30	
Feed intake (g)	60.72	64.28	64.29	64.29	67.88	71.42	71.43	2.58
Digestibility percentages (%)								
DM	75.50 ^a	72.03 ^a	71.78 ^a	66.87 ^{ab}	60.92 ^{abc}	53.07 ^{bc}	51.72 ^c	2.45
CP	65.25	64.30	63.55	58.22	54.52	44.58	43.98	2.78
CF	60.18 ^a	53.59 ^{ab}	50.10 ^{abc}	49.63 ^{abc}	47.01 ^{bc}	37.80 ^d	30.67 ^c	2.43
ASH	76.21	76.10	74.31	71.09	68.68	68.40	63.90	2.50
EE	90.26	88.74	87.00	86.88	86.48	78.91	75.95	1.54
Nitrogen metabolism								
BV	90.05 ^a	88.85 ^b	89.00 ^b	85.50 ^b	81.00 ^c	79.00 ^c	74.00 ^d	1.64
Apparent N D	62.67 ^a	62.00 ^a	60.00 ^{ab}	55.00 ^b	50.00 ^c	45.00 ^d	40.00 ^e	4.67
Energy metabolism]								
Daily E. intake (kcal)	382.8	366.20	351.10	346.80	333.10	322.30	307.10	17.78
Daily E. retained (kcal)	322.4	318.70	341.79	286.35	286.04	276.63	233.70	15.60
DE(kcal/g)	3.37	3.20	2.90	2.87	2.80	2.70	2.40	0.15
ME(kcal/g)	2.68	2.60	2.20	2.11	2.11	2.06	1.72	0.16
Apparent E D	91.00 ^a	90.00 ^a	88.00 ^a	86.00 ^a	85.00 ^a	84.00 ^a	75.00 ^b	1.41

Means along the same row with different superscripts are significantly different ($P < 0.05$)

diet with 0% CRS to 37.80% in diet with 30% CRS. This implied that the fibre in the last diet was not well digested. This was usually the case when dietary fibre is very high in lignin content. This further substantiates claims of Longe and Adetola (1983) and Annison (1990) that pectin and lignin were the limiting factors in the utilization of fibrous plant feed resources. Such wide variation in CF digestibility of concentrate diets was reported by Anugwa *et al.* (1982). The non-significant ($P > 0.05$) difference in ash digestibility between the diets agrees with report of Onifade and Tewe (1993) that diets with adequate mineral supplementation hardly vary in

their total mineral digestibility. The high EE digestibility attested to the good ability of rabbits to utilize dietary fat (Beyen, 1988). The high digestibility of EE is in agreement with the observation of Cheeke *et al.* (1987) and Onifade and Tewe (1993). Effect of cassava root sievate on nitrogen metabolism resulted into a significant ($P < 0.05$) variation difference in the biological value (BV) and Apparent nitrogen digestion (AND) (Table 4). The BV of the animal measures the proportion of the nitrogen retained within the body to the nitrogen digested. Since the crude protein content of the feed decreased as the CRS level increased, it is therefore logical

Table 5: Blood chemistry of rabbits fed CRS

Measurement	Levels of inclusion of CRS (%) in experimental diets							SEM
	0	5	10	15	20	25	30	
SGOT (iu/l)	15.00 ^{cd}	20.00 ^c	21.00 ^c	24.00 ^b	24.00 ^b	29.00 ^a	29.00 ^a	1.07
SGPT (iu/l)	23.00 ^c	26.00 ^c	31.00 ^c	33.00 ^c	36.00 ^b	36.00 ^b	65.00 ^a	2.86
T. protein (g/dl)	7.44 ^a	6.13 ^a	5.97 ^{bc}	5.89 ^{bc}	5.70 ^c	5.25 ^d	5.20 ^d	0.16
Albumin (g/dl)	3.11 ^d	3.14 ^{bc}	3.42 ^{cd}	3.71 ^{bc}	3.77 ^b	3.74 ^b	3.38 ^a	0.08
Globulin (g/dl)	4.33	2.99	2.55	2.18	1.93	1.51	1.82	0.06
Creatinine (mg/dl)	1.30 ^a	1.40 ^b	1.40 ^b	1.55 ^b	1.75 ^b	1.80 ^b	6.30 ^a	0.38
Glucose (mg/dl)	100.00	97.00	93.83	92.50	85.00	77.50	74.50	2.20

Means along the same row with different superscripts are significantly different ($P < 0.05$)

SGOT: Serum Glutamic Oxaloacetate Transaminase

SGPT: Serum Glutamic Pyruvic Transaminase

Table 6: Carcass measurements of weaner rabbits fed graded levels of CRS

Measurement	Levels of inclusion of CRS (%) in experimental diets							SEM
	0	5	10	15	20	25	30	
Live weight (g)	1550.30 ^a	1520.60 ^a	1444.20 ^a	1443.20 ^b	1443.20 ^b	1371.80 ^c	1197.60 ^d	16.74
Dressed Carcass weight (g)	957.93 ^a	955.70 ^a	918.51 ^a	919.90 ^b	926.10 ^a	818.28 ^b	633.05 ^a	28.36
Carcass yield (%)	61.79 ^b	62.85 ^b	63.60 ^{ab}	63.74 ^{ab}	64.17 ^a	59.65 ^c	52.86 ^d	0.80
Organ (%)								
Liver	2.21	2.15	2.18	2.22	2.32	2.39	2.45	0.07
Kidney	0.60 ^b	0.70 ^a	0.62 ^b	0.60 ^b	0.74 ^a	0.77 ^a	0.49 ^c	0.03
Heart	0.24	0.24	0.24	0.24	0.26	0.27	0.29	0.01
Lung	0.77	0.75	0.71	0.70	0.71	0.85	0.72	0.04
Wholesale cut (%)								
Alimentary canal	17.07	18.02	16.99	17.30	18.36	20.20	20.32	0.76
Head	7.94	7.50	8.13	8.11	8.78	7.85	7.80	0.16
Fore limbs	8.57	7.83	8.48	8.30	8.61	7.90	7.44	0.19
Hind limbs	14.30	14.70	15.10	14.44	15.32	13.93	13.02	0.24
Neck	2.26	1.95	2.22	2.10	2.36	2.07	1.56	0.11
Thoracic region	8.65	9.52	9.29	9.70	11.40	9.29	7.30	0.20
Lumber region	9.43	9.90	10.02	10.64	9.06	9.38	8.19	0.22
Cervical region	5.01	3.80	3.70	4.10	4.16	3.79	3.59	0.19

Means along the same row with different superscripts are significantly different ($P < 0.05$).

to conclude that the linear decrease in BV was because of the reducing progression of crude protein in the diets (Table 2). The values of daily energy intake, daily energy retained, DE, ME and apparent energy digestibility showed a decreasing trend with increasing ($P > 0.05$) substitution of wheat offal (WO) with CRS which could be as a result of energy dilution due to the dietary fibre content (Kennelly and Aherne, 1980 and Longe and Fagbenro-Byron, 1990). Inclusion of CRS in the weaner rabbits diet showed a significant ($P < 0.05$) downward trend of the total serum protein which reduced from 7.44g/dl in 0% CRS to 5.20g/dl in the 30% CRS. This could be linked to linear reduction observed in the crude protein content of the diets (Table 2) as Kaneko (1989) reported that total serum protein values of animal decreased with depleting dietary protein level. The liver enzymes serum Glutamic Oxaloacetate Transaminase (SGOT) and Serum Glutamic Pyruvic Transaminase (SGPT) were remarkably increased as the CRS inclusion increased. The result obtained

showed that the control diet had SGPT which was significantly ($P < 0.05$) lowest. This might also suggest the likelihood effect of dietary HCN in the diet which could have affected the proper functioning of the liver. Ekpenyong and Biobaku (1986) reported that blood SGOT and SGPT were high when there was an occurrence of liver damage.

Conclusion

The high carcass yield percentage of rabbit fed 20% CRS inclusion over the other groups indicated that the rabbits deposited more protein as muscle tissue than their counterparts in other treatments. This made almost all the carcass components of the rabbit fed 20% CRS to be higher than the rest groups. The result is in agreement with the reports of Oluokun and Olalokun, (1999). Replacement of WO by CRS up to 20% in weaner rabbits is therefore recommended to obtain high carcass yield percentage for economical purposes.

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